PravdaMC and PacTrack

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Outline

- Introduction
- PacTrk integration
- New Sequence
- Generation
- Simulation
- Reconstruction
- Maps
- Future steps

Introduction

- What is PravdaMC
  - Fast Simulation for BaBar and SuperB Detector
  - Tracking is simulated using TRACKERR routine based on Billoir filter
  - The idea is to create a list of BtaCandidates that mimic those produced by the full reconstruction such that BaBar analysis code can be readily adapted to the new output
  - A single module (PmcMakeBtaCandidates) sequentially runs a series of 'Smear' operators

TRACKERR

- Limitations
  - Coded in Fortran
  - Detector description in flat file with custom format
  - Monolithic approach: no separation of effects of material from resolution of detector
  - Not possible to generate new particles (ex. conversions)

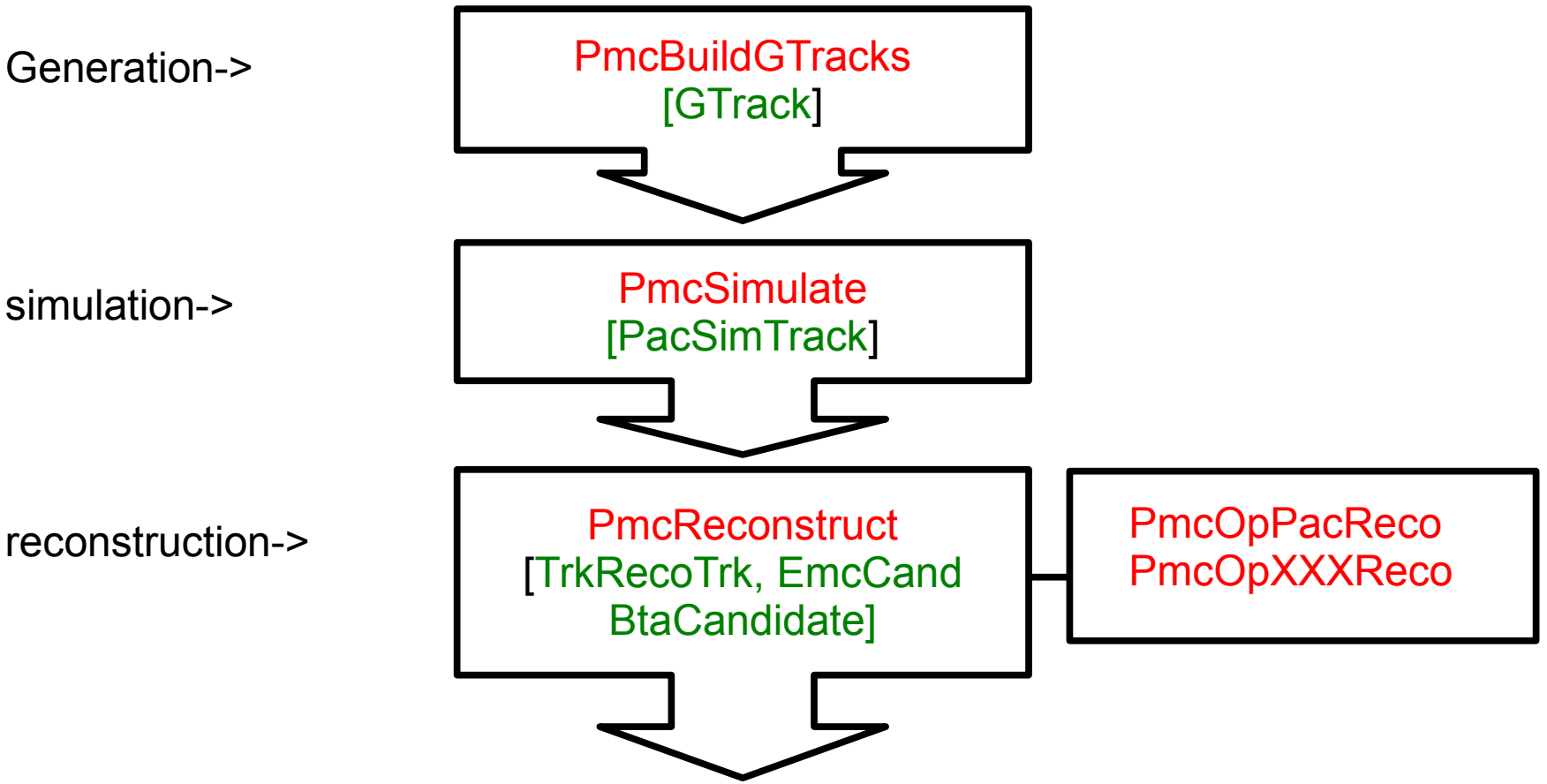
PacTrk integration

- Initial idea was simply to substitute TRACKERR algorithm with PacTrk package developed by D.Brown and derived from the BaBar Kalman filter code
- Ended up creating a framework with better logical separation of various simulation steps and in which other subsystems can easily contribute

New Sequence

- OLD
  - PmcMakeBtaCandLists module
    - The core of PravdaMC module that starts from the Monte Carlo truth and produces 'smeared' candidates
    - (Truth) BtaCandidates -> (Reco) BtaCandidates
- NEW
  - Detector material effects
  - Subsystems are interlinked (ex. PID relies on trking)
  - => higher level of refinement: split this module in several parts
  - Generation => Simulation => Reconstruction

New Sequence



Generation

- MC Truth information is best represented by Gtrack & Gvertex object (instead of StdHepTrk or a BtaCandidate)
  - It has both mother and daughter links
  - It knows both the decay and the production vertex
    - It can be useful to determine where to stop tracking a particle
  - It stores the information about the origin of the particle
    - It was found very useful in detailed tracking studies in BaBar (ex. TrkFixup validation)
  - PmcBuildGTracks / PmcStdHepConverter

Simulation

- PacSimulation implements material effects (multiple scattering, energy loss, track stopping)
- The object that describes the detector (PacDetector) is put in the environment, which means it can be accessed by other subsystems doing reconstruction
- New particles can also be created and added to the list of GTracks with appropriate origin code
- The output of simulation is described by a PacSimTrack object
- =>New module PmcSimulation

Reconstruction

- Starts from PacSimTrack (includes det. effects)
- =>Substitute the 'Smear' operators with 'Reco' operators
  - Each subsystem can implement a PmcOp<Subsystem>Reco that contains the parametrization of the experimental resolution of the detector
  - The output is a list of BtaCandidate objects
  - Additional lists can be put in the event (for example in the tracking we add a list of TrkRecoTrk objects)
  - New Module PmcReconstruct

Tracking Simulation

- PmcOpPacReco
  - This is the actual interface to PacTrk
  - Should be used as a model for how to access the detector geometry information and detector material effect information
  - Simulates Track reconstruction using the 'standard' BaBar Kalman filter
  - A list of TrkRecoTrk objects is put into the event for later use (by PID for example)

Maps

- Need to connect the reconstruction step to the simulation step
  - Map [BtaCandidate (reco) -> PacSimTrack]
- Need to connect the simulation step to the generation step
  - OK: PacSimTrack has a pointer to the GTrack used
- Not necessarily need to connect the generation step to the reconstruction step [close the loop]
  - Map [GTrack -> BtaCandidate (reco)]
    - Also Map [GTrack -> BtaCandidate (truth)] is needed to build the BtaMicroAdapter object

Future Steps / Discussion

- Running outside BaBar environment
  - Many modules from BaBar are not needed, should be eliminated
  - Physics algorithms should be separated from rest to allow BaBar physics program to not loose competitiveness
- PmcMicroAdapter
  - Builds high level micro information from lower level information, needs reorganization
- PID measurement
  - Is built from Hit information, needs to be separated from tracking

Conclusions

- Successfully integrated PacTrk into PravdaMC for track reconstruction simulation
- Generator level ..... GTrack
- Simulation of detector material effects added and separated from Reconstruction simulation
- Maps to link the various steps have been added
- Framework allows integration of other subdetectors, waiting for subsystems code
- More development needed to separate the code from BaBar, build high level information